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## Scientometric Dimension of Research Productivity of a Leading Private University in India

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# *Library Philosophy and Practice*

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## **Scientometric Dimension of Research Productivity of a Leading Private University in India**

### **Abstract**

The study examines the research productivity of KIIT University, Odisha, India in regard to 361 papers indexed in Scopus from the year 2000 to till February, 2013. The study attempts to measure authorship pattern, degree of collaboration, Year wise distribution of articles and corresponding citations, domain wise distribution of articles, ranking of authors, ranking of highly cited papers, collaborating countries and such other parameters. The study finds that the major chunk of research is contributed by three joint authors and the trend of collaborative research is rightly at its peak. The study further reveals that authors of this University have published maximum number of articles in Communications in Computer and Information Science, followed by World Academy of Science, Engineering and Technology, Comparative Clinical Pathology, and International Journal of Information and Management Sciences. The top author of this university is found to have published 25 articles that have been indexed in Scopus. Taken together all the articles published during this period the university has h index of 11.

### **Introduction**

Scientometrics is the quantitative study of the disciplines of science based on published literature and communication. This could include identifying emerging areas of scientific research, examining the development of research over time, or geographic and organizational distributions of research (Glossary of Thompson, 2008). Moreover, Scientometrics is one of the most important measures for the assessment of scientific productions. It is the study of the quantitative aspects of science as a discipline or economic activity. It is part of the sociology of science and has application to science policy-making. It involves quantitative studies of scientific activities, including, among others, publication, and so overlaps bibliometrics to some extent (Tague-Sutcliffe, 1992; Mooghali et al, 2011). Scientific literature is a reflection of scientific activity and productivity (Garfield, 1979). It is part of the sociology of science and has application to science policy-making, and involves quantitative studies of scientific activities (Thirumagal, 2012). The number of publications is considered to be an indication of the scientific output of a group, while the impact is assessed by using data regarding the number of times these publications are cited in subsequent years (Martin and Irvine, 1983). Scientometric analysis can be used to spot and identify promising research areas, to evaluate the research performance of individual researchers, research groups of different universities and countries, and to identify the relations between authors, institutions, and journal papers (Kim and Kim, 2000).

Scientometric evaluation is a very key component of any research and development activity. One well known productivity indicator is the number of publications produced by the scientists, institutions and countries. Studies like this will provide some insight into the complex dynamics of research activity and enable researchers, scientists, policy makers and science administrators to provide adequate facilities and proper guidance in which direction the research has to be conducted (Kademani, et al, 2006). Hence, such an indispensable technique is used to evaluate the quality and quantity of literature published across disciplines within a particular geographical area.

### **Materials and Methods**

The source items, i.e. records of publications by the faculty members of KIIT University, were all the documents published in international journals and proceedings indexed by the Scopus (Elsevier Bibliographic Database) for the years 2000 to 2013. To refine the result value the search was made under the query. The advanced search resulted in a total of 361 articles of KIIT University indexed in Scopus. All papers having an authorship or a co-authorship associated with KIIT University were included and the number of citations received by them was counted for the period. The study considered the papers indexed in *Scopus* till February, 2013.

**Limitations**

This paper examines exclusively 361 papers of KIIT University that have been indexed in Scopus database ranging from the year 2000 to early 2013. Thus, the papers of KIIT University published in other different channels and sources which have not been indexed in *Scopus* are excluded from the purview of the research.

**Objectives**

- To determine research productivity of academic and research community working in KIIT university;
- To make an analysis of publications produced by KIIT university;
- To identify the number of contributions published during the time period of study;
- To compare the year wise distribution of research publications;
- To study the authorship pattern of research publications;
- To find out the ranking of leading contributors;
- To study the subject coverage of publications; and
- To determine the preference of research communication channel among research community.

**About KIIT University**

KIIT University, Odisha, India took its shape as an institute in 1997 when B.Tech, MCA and MBA courses were started. It was declared a university (u/s 3 UGC Act of 1956) in 2004, within only six years of commencement of Degree programmes, thus earning its place in the Limca Book of Records. Taking its growth to the next level, dedicated schools to offer Bachelor and/or Master Degree programmes in Rural Management, Biotechnology, Law, Medicine and Dental Sciences were established in 2007. At present, KIIT has 23 schools offering more than 50 academic programmes. Responding to the needs of globalization, KIIT in its endeavour to reach out to every knowledge centre of the world has entered into academic partnership with more than 60 world class universities. In order to promote knowledge sharing and collaborative research, KIIT embraced membership of several important institutions including the International Association of Universities (IAU), Association of Indian Universities (AIU), Association of Commonwealth Universities (ACU), International Association of Universities Presidents (AUP) and University Mobility in Asia and the Pacific (UMAP). KIIT has the honour of housing the Indian Secretariat of UMAP which has a membership of over 466 universities across Asia and the Pacific. Internationalization of KIIT is not confined to its membership in several bodies and bilateral partnership alone, but enjoys acceptability by students, researchers of universities across the globe. Students from nearly 22 countries are pursuing their studies here while students and researchers from KIIT are engaged in academic activities in more than 15 countries, a fact that puts KIIT in league with

the best institutions of the country (<http://www.kiit.ac.in/aboutus/overview.html>). Therefore, a scientometric study of research output of this Indian university is of interest.

### Literature Review

Quite a few reported studies have so far been carried out on scientometric analysis of research productivity of individual institutions and published literature of journals. In the afore said direction, Jeevan and Gupta (2002) analysed research productivity of nine departments of IIT, Kharagpur by analyzing proportion of papers covered in SCI, Impact rate, Proportion of high quality papers and Publication Effectiveness Index (PEI), degree of collaboration among authors and such other parameters. One of the major findings of the study depicted that only four departments have received the PEI value just above *one*. Lee (2003) found that IMCB researchers have been very selective in where they publish and the articles received an average of 25 to 35 citations per article, and the percentage of uncited articles is 11.6%. Four articles received more than 200 citations, and 18 received between 100 to 200 citations. Sharma (2009) studied the research performance and collaborative prototype of research among scientists of *Central Potato Research Institute* and revealed that majority of scientists preferred to work in collaboration and subsequently published their research results in joint authorship mode. Bonilla-Calero (2008) in the study entitled, 'Scientometric analysis of a sample of physics-related research output held in the institutional repository Strathprints' revealed that the USA and England, together with Germany, are the main countries engaged in collaborative work. These first two are among the countries that cite and download most and that have the highest number of publications with no Scottish centres. Serenko, et al.(2010) in the scientometric analysis of knowledge management and intellectual capital academic literature addressed a number of research questions pertaining to country, institutional and individual productivity, co-operation patterns, publication frequency. From the findings of their study, many implications emerged that improve one's understanding of the identity of Knowledge Management as a distinct scientific field. Davarpanah (2010) reveals that the differences in rankings for measures of publication output, citation distribution, and mean observed citation rate are large, which justifies the use of the scientific power index. Repanovici (2011) depicts the results of a scientometric study made at the Transilvania University of Brasov regarding the H-Index of the academic staff and analyzes the research performances achieved by Brasov academic community. Swain (2011) conducted a scientometric appraisal of *Library Philosophy and Practice* (LPP) and vividly depicted the multidisciplinary trend of LPP other than library science it has covered significant research contributions from the domain of Education, Medical Sciences, Sociology, Psychology,

Baby and Kumaravel (2012) studied research productivity of Periyar University faculties in India using the Scopus database for a period of thirteen years from 1998 to 2010. The study found that three-authored publications dominated the pattern of authorship and journal articles occupied the predominant place among other sources of publication. Majhi and Maharana (2012) analysed the growth and development of Physical Science research in Sambalpur University from 1971 to 2010 in terms of publication output as reflected in *Scopus*. The study found that the contributions in physical science literature ranged from single authored publications to more than 10 authors and the quantum of research output dominated from the collaborative front. Thirumagal (2012) analysed the scientific publications of Manonmaniam Sundaranar University, Tirunelveli, Tamilnadu and found that most scientists published their results in India, followed by South Korea, the USA and Japan. Even though the scientists who published articles are in India, they got a Total Global Citation Score of 1502.

## Results and Discussions

### Authorship pattern

Table 1 shows the authorship pattern of the volume of research work carried by the researchers of KIIT University. It is evident that the major chunk of research is contributed by *three joint authors* (119 papers) followed by *Two joint authors* (97 papers), *> four joint authors* (74 papers), and *four joint authors* (52 papers). However, the single-authored papers (22 papers) are quite less in comparison papers emanating from collaborative front. Hence it is crystal clear that a trend of collaborative research in KIIT University is rightly at its peak at present.

Table 1 Authorship pattern

Year	Single	Two	Three	Four	> Four	Total
2013	1	6	7	1	7	22
2012	4	19	35	13	19	90
2011	3	33	33	17	21	107
2010	6	20	24	7	15	72
2009	2	8	12	8	6	36
2008	1	5	0	3	3	12
2007	0	1	2	1	0	4
2006	0	1	3	0	2	6
2005	0	0	0	1	0	1
2004	2	1	1	0	0	4
2003	0	0	1	1	1	3
2002	0	2	1	0	0	3
2001	0	0	0	0	0	0
2000	0	1	0	0	0	1
Total	19	97	119	52	74	361

### Co-authorship and degree of collaboration

Co-authorship is a kind of scientific collaboration in which two or more authors share their ideas, resources and data to create a joint work (Inzelt et al, 2009; Nikzad, 2012). Thus, it is essential to measure the intensity of co-authorship trends through the degree of collaboration among the authors of KIIT University. The degree of collaboration among researchers of KIIT University can be calculated by using Subramanyam's formula (1983) as:

$$DC = \frac{NM}{NM+NS}$$

Where:

DC=Degree of collaboration

NM=number of multiple authored papers

NS=Single authored papers

Here, DC= 339/ (339+22) =0.93

Since DC value is greater than 0.5 and tends to 1, it is evident that multi authored articles occupy the prominent position indicating the supremacy of team research carried out by the researchers of KIIT University.

### Year wise distribution of articles

Table 2 shows the year wise distribution of articles that have been published and indexed in Scopus from the year 2000 to early 2013. It is found that research productivity of KIIT University has witnessed the notable volumes of research in the year 2011 (107 articles), followed by 2012 (90 articles), and 2010 (72 articles). Interestingly, more than half of the publications have been reported from the year 2010 to till date (Figure 1). This is considerable evidence that the University management has truly given serious introspection to expand the research infrastructure and enhance its intellectual capital these days.

Table 2 Year wise distribution of articles

Year	No of articles	Cumulative no of articles	%	Cumulative %
2000	1	1	0.28	0.28
2002	3	4	0.83	1.11
2003	3	7	0.83	1.94
2004	4	11	1.11	3.05
2005	1	12	0.28	3.33
2006	6	18	1.66	4.99
2007	4	22	1.11	6.10

2008	12	34	3.32	9.42
2009	36	70	9.97	19.39
2010	72	142	19.94	39.34
2011	107	249	29.64	68.98
2012	90	339	24.93	93.91
2013	22	361	6.09	100.00

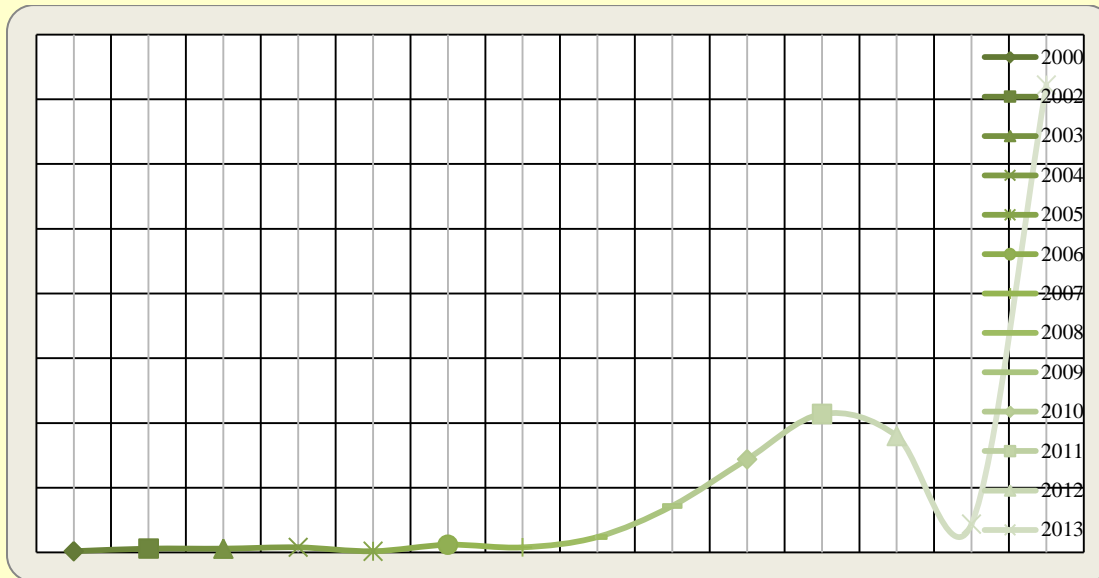


Figure 1 Year wise distribution of articles

**Year wise distribution of citations**

It is found that, out of 361 research publications of KIIT University, 117 articles have already received 623 citations with an article impact of 1.72 (total no of citations/total number of citable papers). Table 3 (Figure 2) depicts the year wise distribution of citations of the citable articles published in different years. It is evident from the analysis that, articles of year 2010 have so far received highest number of 204 citations followed by articles of 2006 (100 citations), and 2009 (80 citations). It is deduced that, the year 2010, 2006, and 2009 have yielded some outstanding papers. Therefore, it is the considerable evidence that though the year 2010 has as witnessed a total production of 72 articles which is lesser than the production of articles in year 2011 (107 articles) and 2012 (90 articles), but it has produced the most qualitative research out put that have received wide impact all around.

Table 3 Year wise distribution of citations

Year	No of citations	Cumulative citations	% of citations	Cumulative % of citations
2000	7	7	1.12	1.12
2002	44	51	7.06	8.18



2003	19	70	3.05	11.23
2004	10	80	1.61	12.84
2005	2	82	0.32	13.16
2006	100	182	16.05	29.21
2007	5	187	0.80	30.01
2008	27	214	4.33	34.35
2009	81	295	13.00	47.35
2010	212	507	34.03	81.38
2011	81	588	13.00	94.38
2012	35	623	5.62	100.00
2013	0	623	0.00	100.00

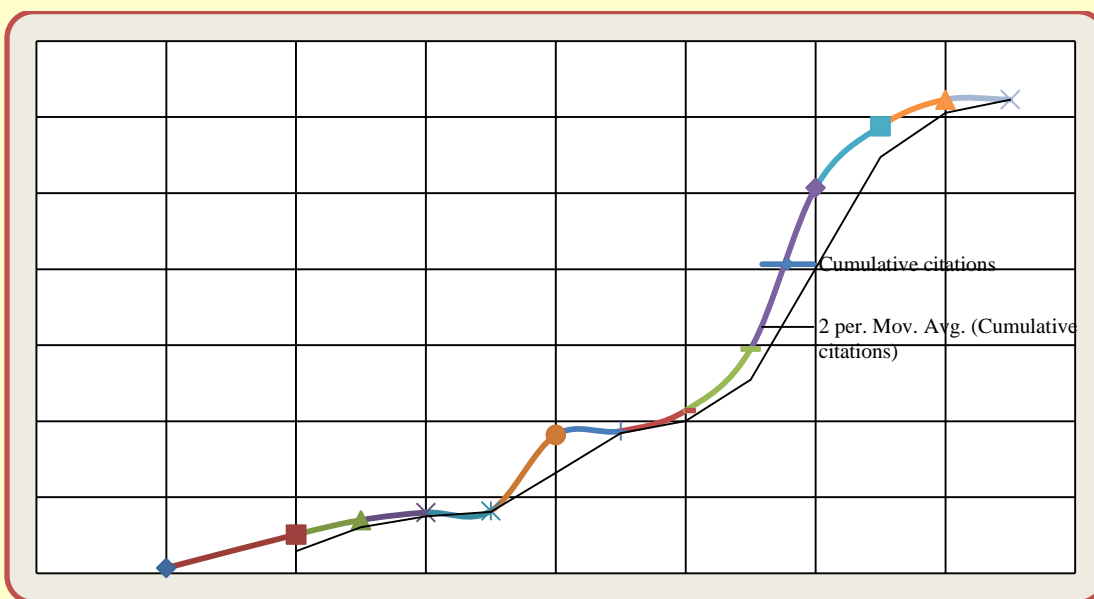


Figure 2 Trend of cumulative citations

**Ranking of authors by number of contributions**

The study sought to know the leading authors, number of contributions, total number of citations they have received at their individual capacity by their cumulative contributions, and their respective *h-index*. The *h-index* for each of the authors was computed by compiling the number of works and the corresponding citations of the respective authors so far indexed in the *Scopus database* under the affiliation of KIIT University. The authors’ article emanating from other different affiliations were thus excluded from the purview of research. Ranking of authors by number of contributions is depicted in Table 4.

Table 4 Ranking of authors by number of contributions

<i>Sl No</i>	<i>Rank</i>	<i>Author</i>	<i>No of Papers</i>	<i>h-index</i>	<i>Total citations</i>
--------------	-------------	---------------	---------------------	----------------	------------------------

1	1	Goswami, V.	25	5	77
2	2	Tripathy, A.	21	2	6
3	3	Mishra, M.K.	12	2	7
4	4	Singh, U.P.	11	4	38
5	5	Patra, P.K.	10	1	5
6	6	Suar, M.	9	2	62
7	6	Sharma, R.	9	2	7
8	6	Soni, V.K.	9	2	7
9	7	Mund, G.B.	8	2	12
10	7	Roy, J.S.	8	1	3
11	7	Sonawane, A.	8	3	19
12	8	Mohapatra, P.	7	4	33
13	8	Kundu, C.N.	7	4	33
14	8	Panda, S.	7	1	13
15	8	Preet, R.	7	4	33
16	8	Das, S.K.	7	2	11
17	9	Samanta, S.K.	6	3	24
18	9	Mohapatra, D.P.	6	2	9
19	9	Swain, D. K.	6	2	6
20	9	Dehuri, S.	6	1	2
21	9	Gupta, B.	6	0	0
22	9	Jena, P.	6	3	15
23	10	Panda, U.C.	5	2	87
24	10	Rath, H.	5	2	16
25	10	Rout, A.K.	5	3	20
26	10	Dash, P.	5	2	16
27	10	Sahoo, P.K.	5	5	38
28	10	Routara, B.C.	5	1	6
29	10	Panda, G.	5	1	12
30	10	Mishra, K.G.	5	2	4
31	10	Som, T.	5	2	16
32	10	Gupta, U.C.	5	3	45
33	10	Goswami, L.	5	1	5
34	10	Acharya, A.A.	5	1	1
35	10	Swain, P.K.	5	1	1
36	10	Swain, S.C.	5	1	12
37	10	Swain, S. K	5	5	38
38	10	Tarasia, N.	5	0	0

Table 4 reveals top 10 ranked authors of KIIT University. It is found that Veena Goswami who happens to be the Dean, School of Computer Application leads

the table with a record number of 25 papers followed by A. Tripathy, Associate Dean, School of Computer Engineering (21 papers). However, M. K. Mishra (12 papers), and U. P. Singh (11 papers) are ranked *third* and *fourth* respectively. It is further evident that two prolific authors who have so far received fair impact of their research work are Veena Goswami (77 citations; h=5), and U. P. Singh (38 citations; h=4).

### Ranking of journals

It is evident from Table 5 that authors of KIIT University have published maximum number of articles in *Communications in Computer and Information Science* (14 articles), followed by *World Academy of Science, Engineering and Technology* (7 articles), *Comparative Clinical Pathology*, and *International Journal of Information and Management Sciences* (4 articles each). Since major chunks of research papers of KIIT University are emanated from the domain of Computer Science (Table 5), researchers of this subject have opted for *Communications in Computer and Information Science* as the first choice.

Table 5 Ranking of journals

Rank	Name of the journal	No of articles
1	Communications in Computer and Information Science	14
2	World Academy of Science, Engineering and Technology	7
3	Comparative Clinical Pathology	4
3	International Journal of Information and Management Sciences	4
4	Advanced Materials Research	3
4	Composites: Mechanics, Computations, Applications	3
4	International Journal of Advanced Manufacturing Technology	3
4	Journal of Intellectual Property Rights	3
4	PLoS ONE	3
5	Advances in Intelligent Systems and Computing	2
5	Applied Biochemistry and Biotechnology	2
5	Applied Mathematical Modelling	2
5	Bioorganic and Medicinal Chemistry Letters	2
5	Computers and Industrial Engineering	2
5	Computers and Mathematics with Applications	2
5	Computers and Operations Research	2
5	Electronic Journal of Geotechnical Engineering	2
5	Electronic Library	2
5	Environmental Earth Sciences	2
5	European Journal of Scientific Research	2

5	IEEE Transactions on Systems, Man, and Cybernetics	2
5	Indian Concrete Journal	2
5	Indian journal of public health	2
5	Infection and Immunity	2
5	International Journal of Pharma and Bio Sciences	2
5	Journal of Applied Fluid Mechanics	2
5	Journal of Applied Physics	2
5	Journal of the Institution of Engineers (India)	2
5	Journal of Theoretical and Applied Information Technology	2
5	Library Philosophy and Practice	2
6	130 individual journals	130
	Total	215

### Subject wise distribution of articles

It is evident that, the researches in the field of computer Science is found at the top with a record number of 140 articles followed by Engineering (118 articles), and Mathematics (47 articles). However, Dentistry remains at the bottom with the contribution of just 1 research paper. The details of the subject wise distribution of papers are depicted in Table 6.

Table 6 Subject wise distribution of articles

<i>Sl No</i>	<i>Subject</i>	<i>No of papers</i>
1	Computer Science	140
2	Engineering	118
3	Mathematics	47
4	Materials Science	45
5	Biochemistry, Genetics and Molecular Biology	34
6	Medicine	32
7	Physics and Astronomy	31
8	Social Sciences	26
9	Agricultural and Biological Sciences	16
10	Chemistry	18
11	Earth and Planetary Sciences	15
12	Business, Management and Accounting	14
13	Decision Sciences	14
14	Chemical Engineering	10
15	Immunology and Microbiology	12
16	Environmental Science	10

17	Energy	8
18	Pharmaceutics	6
20	Arts and Humanities	2
21	Economics, Econometrics and Finance	2
22	Multidisciplinary	2
23	Psychology	2
24	Dentistry	1

Note: Since several papers are multi-disciplinary in nature, N> 361

### Ranking of highly cited papers

Table 7 shows the ranking of articles which have received fair impact all around in terms of number of their respective citations. It is evident that papers originating from department of chemistry (5 papers), School of Biotechnology (3 papers), School of Computer Application (2 papers), and School of Electronics Engineering (2 papers) are reported to have received good impact with reasonable citations.

Table 7 Ranking of highly cited papers

<i>Ran k</i>	<i>Title of the Article</i>	<i>Name of the Journal</i>	<i>Author(s)</i>	<i>School/Dept.</i>	<i>Citatio n Count</i>	<i>Year of Publicat ion</i>
1	Application of factor and cluster analysis for characterization of river and estuarine water systems - A case study: Mahanadi River (India)	Journal of Hydrology	<u>Rath</u> , P., et al	Chemistry	56	2006
2	Like will to like: Abundances of closely related species can predict susceptibility to intestinal colonization by pathogenic and commensal bacteria	PLoS Pathogens	Suar., M et al	Biotechnolo gy	52	2010
3	Biochemistry of microbial degradation of hexachlorocyclohex	Microbiology and Molecular Biology	<u>Raina</u> , V et al	Biotechnolo gy	40	2010

	ane and prospects for bioremediation	Reviews				
4	Performance analysis of finite buffer discrete-time queue with bulk service	Computers and Operations Research	Goswami, V. et al	Computer Application	31	2002
5	Use of sequential leaching, mineralogy, morphology and multivariate statistical technique for quantifying metal pollution in highly polluted aquatic sediments-A case study: Brahmani and Nandira Rivers, India	Journal of Hazardous Materials	Rath, P., et al	Chemistry	18	2009
6	N-fused imidazoles as novel anticancer agents that inhibit catalytic activity of topoisomerase II $\alpha$ and induce apoptosis in G1/S phase	Journal of Medicinal Chemistry	Preet, R, et al	Biotechnology	16	2011
7	Structural evolution of TiO <sub>2</sub> nanocrystalline thin films by thermal annealing and swift heavy ion irradiation	Journal of Applied Physics	Singh, U. P., et al	Electronics Engineering	14	2009
7	Discrete-time bulk-service queues with accessible and non-accessible batches	Applied Mathematics and Computation	Goswami, V. et al	Computer Application	14	2006
8	Synthesis, crystal structure and magnetic	Inorganica Chimica Acta	Rout, A K., et al	Chemistry	12	2010

	characterization of a series of four phenoxo-bridged binuclear manganese(III) Schiff base complexes					
8	Effect of Cu(II)/H <sub>2</sub> Salen complex on the non-conventional initiated emulsion polymerization of acrylonitrile	European Polymer Journal	Swain.,S. K. et al	Chemistry	12	2002
9	Design and analysis of SSSC-based supplementary damping controller	Simulation Modelling Practice and Theory	Swain, S.C., et al	Chemistry	11	2010
9	Study of geochemical association of some trace metals in the sediments of Chilika Lake: A multivariate statistical approach	Environmental Monitoring and Assessment	Rath, P., et al	Chemistry	11	2006
10	Surface sulfurization studies of Cu(InGa)Se <sub>2</sub> thin film	Solar Energy Materials and Solar Cells	Singh, U. P., et al	Electronics Engineering	9	2006

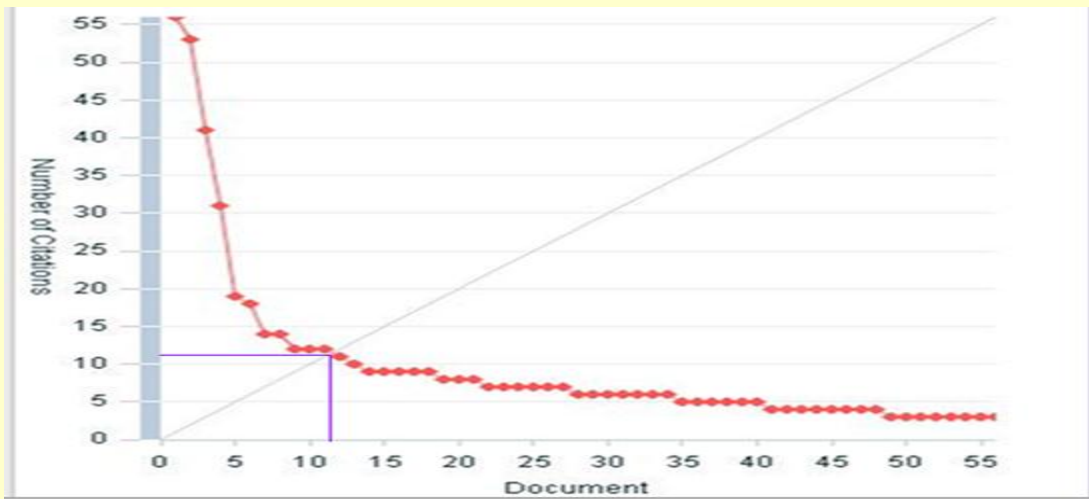


Figure 3 Document h-graph showing h-index-11

It is evident from figure 3 that 55 out of 361 publications of KIIT University have so far received citations in other different works. However, it has managed to achieve h-index of 11. It can be predicted that the visibility and the accessibility of the works will grow further by drawing more citations and improving the value of *h-index* in days ahead.

**Collaborating countries**

Researchers of KIIT University have published their papers in collaboration with 21 different countries. It is found from Table 8 that majority of 20 papers of this university have been published in collaboration with researchers of the United States, followed by Switzerland (8 papers), Germany (7 papers), Australia (6 papers), Canada, Norway, and South Korea (5 papers each). However, the visibility of research in collaboration with Austria, Denmark, Finland, Malaysia, Netherlands, Portugal, South Africa, Spain, United Kingdom (1 paper each) is found less.

Table 8 Collaborating countries

Sl No	Countries	No of Papers
1	United States	20
2	Switzerland	8
3	Germany	7
4	Australia	6
5	Canada	5
6	Norway	5
7	South Korea	5
8	France	4
9	Sweden	4
10	Azerbaijan	2



11	Singapore	2
12	Taiwan	2
13	Austria	1
14	Denmark	1
15	Finland	1
16	Malaysia	1
17	Netherlands	1
18	Portugal	1
19	South Africa	1
20	Spain	1
21	United Kingdom	1

### Major findings

The major findings of the study are depicted as under:

- It is evident that the major chunk of publications of KIIT University is contributed is contributed by *three joint authors* followed by *two joint authors*, *> four joint authors*, and *four joint authors*. However, the *single-authored* papers are quite less;
- The degree of collaboration in research productivity of KIIT University is found to be 0.93;
- It is found that research productivity of KIIT University has witnessed the notable volumes of research in the year 2011 (107 articles), followed by 2012 (90 articles), and 2010 (72 articles);
- The study reveals that, though the year 2010 has as witnessed a total production of 72 articles which is lesser than the production of articles in year 2011 (107 articles) and 2012 (90 articles), but it has yielded the most qualitative research out put that have received wide impact all around;
- It is further evident that two prominent authors who have so far received fair impact of their research work are Veena Goswami (77 citations; h=5), and U. P. Singh (38 citations; h=4); and
- 20 papers of this university have been published in collaboration with researchers of United States, followed by Switzerland (8 papers), Germany (7 papers), Australia (6 papers), Canada, Norway, and South Korea (5 papers each).

### Conclusion

It is observed from the study that, KIIT University has witnessed a few visible research publications from 2000 to 2007 (22 articles). However, there has been a constant rise of publications since the year 2008 and the year 2011 is recognized as the most productive year producing a record number of 107 articles. The top

author of this university is found to have published 25 articles that have been indexed in Scopus. Taken together all the articles published during this period the university has h index of 11. Moreover, many research papers of this university have got wide impact and fair amount of citations. It is felt that the management of KIIT University has given right consideration and serious introspection to augment and expand its research avenues and intellectual capital. Furthermore, the study predicts that the accomplished researchers of this university will come forward to garner all their research experiences to take the status of this university to its peak.

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